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**THE RAPIDLY PROPAGATING KUNG-NUNG MODEL 7  
HAND TRACTOR.**

Source: Chugoku Sangyo Shashin Tsushin (Photos and Features on Chinese Industry), No 48, 15 July 1965, pp 1-11

**Tractors, the Stars of Agricultural Machinery**

In 1955, China started construction on the First Loyang Tractor Manufacturing Workshop which officially started production in 1958. Until then, for tractors people exclusively relied on foreign imports but during the year of the Great Leap Forward when the Loyang Tractor ~~Factory~~ Workshop started production, the ~~existing~~ mechanical plants in various parts of China were already putting out more than 240 varieties of tractors. After 1955 more than ten tractor manufacturing plants were constructed in Tientsin, Anshan, Shenyang, Changshun, Kwangtung, Shih-chia-chuang, Shanghai, etc. and as a consequence, a great deal of tractors came to be produced.

**Number of Tractors in All of China**

1952	1,532	(1)	1960	79,000	(3)
1956	19,367		1961	99,000	(4)
1957	24,629		1962	100,000	(5)
1958	45,330	(2)	1963	113,293	(6)
1959	59,000		1964	123,145	(7)

Sources: (1) 1957 People's Handbook

(2) National Statistical Bureau, Ten Great Years

(3) Li Fu-chun report at the 1960 National People's Congress

(4) By adding 40,000 to the 1959 figure (the supposed increase)

(5) Jenmin Jihpao editorial ~~of~~, 9 November 1962

(6) Reckoned from essays on rice in Chinese newspapers published 3 October 1964

(7) Reckoned from Chou En-lai's report to the 1964 People's National Congress

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### Six Standard Models Appropriate for China

Up to now the main tractors produced ~~in China~~ in China ~~have~~ have been the "Tung-fang-hung" Model 54 ~~and the~~ large-size caterpillar tractors produced by the First Loyang Tractor Manufacturing Workshop. These tractors are ~~almost~~ almost as large as the imported tractors, they are merely Chinese copies of foreign large-size tractors. But the terrain of China is not uniform as in the ~~Soviet~~ Soviet Union or in the States, it is formed with plains and mountain lands, with dry and wet ~~fields~~ that are separated ~~from~~ from each other ~~but~~ by very little distance, that require intensive cultivation and ~~present~~ very complex management. For this reason, to produce tractors that would fit the actual conditions of the agriculture of China as well as its industrial conditions requires continuous efforts over ~~several~~ several years.

The medium and small-size tractors ~~xxx~~ have a higher economic value, while they can do all the functions at the start of the season, at mid-season or at harvest time. Besides, they require little raw materials, fuel~~x~~ and labor. Even on wide plain areas, the combination of large-~~xx~~ size with medium and small-size tractors can be very effective. This is why in China people have followed the maxim of combining large, medium and small-size tractors while stressing the middle and small-size ones, and of making full use of all of them. However, there are at present more than 100 models of tractors in current use in China and since this ~~is~~ makes for a great deal of inconvenience as far as usage, management and repair work are concerned, a maxim has been taken to lay down stipulations as to the models and series of tractors and Diesel engines, to reduce as much as possible the production series, and to heighten the efficiency of production, use and repair work. Then, after years of study and experimental use in the fields, six models have been decided upon which are not only rational in construction and of high efficiency but which also fit with the natural conditions of ~~the~~ various areas and with the ~~different~~ requirements of different cultures. These models are also in line with the ~~xxxx~~ level of mechanical industry in China. The six models that have been decided upon and which are now being produced are as follows:

#### Hung-ch'i 100

This is a large-size caterpillar tractor with a motor generating power of 100 PS, fuel consumption rate ~~of~~ 210 g/PS/h, weight 11,100 kg, fit for large cultivation surfaces but can also be used both industrially and agriculturally, can be changed into a bulldozer, power shovel, roller, and crane for use in irrigation or earthwork.

#### Tung-fang-hung 75

This is an improvement on the design of the basic Tung-fang-hung 54

Model, it is a caterpillar tractor with a motor generating power of 75 PS, a fuel consumption rate of 205 g/PS/h, weight 5,100 kg, fast speed, high cultivation efficiency, capable of tilling 14 mu (one mu is 1/15 of a hectare) per hour, it can also be used ~~for~~ for soil preparation and sowing purposes and is particularly fit for dry field cultivation in the Northeast and in the North.

#### Tung-fang-hung 54

It is a caterpillar tractor of 54 PS meant chiefly for dry field cultivation in the plains. It is the model that is produced in the greatest quantity in China and because it has been long in use, ~~it is a solid machine of easy manipulation~~ it has been proven to be a solid and fine machine of easy manipulation and high efficiency.

#### Nung-shou 35

A multi-purpose tire tractor, it has a motor generating power of 35 PS, a fuel consumption of 215 g/PS/h, and weighs 1400 kg. It can make small ~~xxxx~~ circles, it can work on narrow wetfields of 3-5 mu up and tills about 5 mu per hour. The quality of its work is good and it is easy to move around. It has been specially designed for cultivation on wetfields in the South and can be used for such purposes as the administration of fertilizers, drainage and irrigation, transport.

#### Tung-fang-hung 28

This is also a small-size multi-purpose tire tractor. 28 PS. Designed specially for handling such ~~wet~~ terrains as cotton and corn fields, it is characterized by a high chassis, adjustable wheel distance, a large range of speeds with the maximum speed of 25 km per hour. It is fit for a whole range of operations: initial cultivation, soil breaking, soil preparation, sowing of seed, ~~mid~~ mid-season cultivation, application of fertilizers, and transport.

#### Kung-nung 7

A hand tractor.

#### Birth of the Kung-nung Model 7 Hand Tractor

In 1958, the Nan-ch'ang Diesel Engine Workshop started to manufacture hand tractors by producing five of them. ~~xxxx~~ A hand tractor is a tractor fit for cultivation in both kinds of fields, the wet and the dry, with a ~~tactile~~ power of ~~xxxx~~ one ton, while costing only 3,500 yuan. In 1962, when the Ministry of Agriculture organized a conference of agricultural technicians in 11 southern provinces and autonomous zones, they reached the conclusion that for use in wetfields, the hand tractor is as appropriate as the ~~xx~~ Nung-shou 35 Model tractor.

Heeding this conclusion, in 1963, the Shanghai Tractor ~~Work~~ Workshop completed the design of the Kung-nung 7 Model Hand Tractor which ~~they~~ it succeeded in producing on an experimental basis thanks to the cooperation of other plants such as the Shanghai Power Machine Plant, etc. In February 1964, this model was selected to be a standard model by the National Assessment Commission: as a consequence, in the first half of 1964 ~~since~~ after ~~production~~ mass production had officially started, Shanghai alone already produced 203 such tractors. Also in the first half of that year, the Peking Hsuan-shih Machine Workshop, then Shenyang's Tungsheng Agricultural Machinery Workshop in November succeeded in the production of the tractor on an ~~experimental~~ experimental basis. At the beginning of 1965, the Small-Size Tractor Workshops of Wuhan ~~had~~ also succeeded in mass producing it with the cooperation of the Wuhan Diesel Engine Workshop. At present, thanks to the standard blueprints of the Eighth Machine Industry Department, besides ~~through~~ Shanghai, Shenyang and Wuhan, other places such as Ch'ang-chou and Fukien have also come to mass produce the new model.

In every locality, whenever they manufacture this hand tractor, many plants would pull together dividing the production into two main branches, the production of Diesel engines ~~and~~ (Model 195) and the production of chassis, and before starting mass production, they would carefully experiment with the model in the countryside first. Thus, two years of actual use of the Kung-nung 7 model have fully demonstrated its superiority. That is, it can be used for work on wetfields, on vegetable garden fields, on orchards, and on hilly terrace fields, it is best fit for small-size plots but is also fine as adjunct to the large-size tractors. Its ~~horse~~ horse-power is ~~very~~ appropriate for use in fixed operations and it is also ~~very~~ convenient to move around. Should it have all the attachments and related agricultural machinery, its over-all rate of utility during the year comes to above 70 percent. The volume and price of the new model are tailored to the purchasing and utilizing capacity of the people's communes and production ~~brigade~~ teams, it is also easy to manage.

Consequently, we can foresee that this Kung-nung Model 7 ~~M~~ hand truck is going to propagate fast to the people's communes everywhere. Hereunder, we would like to present the specifications of the new model as found in the standard design charts of the Eighth Machine Industry Department.

#### Specifications of Kung-nung 7 Tractors

Form: Manual, single-axed, ~~type~~ tire type.

Size: in millimeters, 2570 x 807 x 1050.

Distance to ground plan: 250 mm from the ground plan to the oil-releasing screw of the transmission part.

Distance between the wheels: in millimeters, 482, 542, 640, and 700.

Weight: when dry, 485 ± 10 kg

Running speed: 5 : 00 - 12 tires, motor gives 1500 rpm.

Speed (km/h)			Speed (km/h)		
	With regular pulley	With fast pulley		With regular pulley	With fast pulley
Forward			V	4.56	8.85
I	1.28	2.48	VI	7.13	13.84
II	1.67	3.24	Backward		
III	2.01	3.90	I	1.60	3.10
IV	2.61	5.06	II	2.51	4.86

Revolutions per minute of rotating plough: motor gives 1500 rpm, with a low speed of 182 and a high speed of 273.

Gear operation: Speeds I and II, cultivation depth x cultivation breadth at highest range is 180 mm (usually 120-160 mm) x 614 mm.

Tactile power: On wetfields (iron wheels, paddy fields, at speeds III and IV) is 160-200 kg. On dry fields (rubber tires, wheat fields, at speeds III and IV), it is 180-200 kg. For road transport (rubber tires, automobile roads, at speed V), it is 260-290 kg.

#### Motor

Form: Model 195, horizontal, single cylinder, four-stroke Diesel engine.

Size (in millimeters, length x width x height): 935 x 600 x 590.

Cylinder diameter x strokes (in millimeters): 95 x 115.

Compression rate: 17.5.

Revolutions per minute (rpm): 1300-1500.

Related power: 6-7 PS.

Stipulated fuel consumption (g/PS/h): < 200.

Stipulated lubricating oil consumption (g/PS/h): 5.

Weight (at dry state, in kg): 185 ± 2 %.

Starting method: By hand, with installation of pressure reduction.

Cooling method: Water boiling and steam sending method.

Lubrication method: Pressure sending, blowing method, oiling.

Steam distribution: Intake valve opens at 5° before upper dead point, closes at 40° after lower dead point; exhaust valve opens at 40° before lower dead point and closes at 5° before upper dead point.

Between-valve gap (in millimeters, at cold state); Intake valves, 0.4 mm; exhaust valves, 0.5 mm.

Fuel pumps: single shift gear, oil pressure from 2 to 3.5 kg/cm<sup>2</sup>; nozzle: ~~multi~~ multi-valve closing method, jet pressure of 160 kg/cm<sup>2</sup>; speed regulator: ~~centrifugal~~ centrifugal all through.

Power extracting method (Extracting from the motor crank axis edge): V-pulley of 236 mm for large wheels, two B-model pulleys of 142 mm for small wheels, three B-model pulleys with average diameter x width equal to 113 mm x 140 mm, with key accessory axis diameter of 40 mm.

### Chassis

Clutch: Dry type, two-face, friction, ordinarily gear-engaging type, transmission box: cogwheel transmission, coupling type, breaks: band type installed on clutch axis, directing mechanism: right and left gear-engaging type clutches, oil valves: flexible ~~tap~~ tube, collapsible type hand valves.

Running wheels: Rubber ~~tyres~~ tires (5 : 00 - 12, air pressure 2 kg/cm<sup>2</sup>) or iron wheels, cultivating rear wheels (rubber tires) of diameter x width (in millimeters): when close together 280 x 22, and when far apart 280 x 30, ~~rear~~ transport rear wheels 3 : 50 - 5 tires, air pressure 2.5 kg/cm<sup>2</sup>, saddle 1, balance ~~at~~ weights 5kg for two, cultivation equipment: horizontal, 16 running type rotating plough, plough model: regular straight share, straight share with blades ~~not~~ attached, pointed head straight share, and bending type, that is, four types altogether.

### Fuel and Lubricating Oil Specifications

Fuel: Number 20 or Number 10 light Diesel oil (SYB 1071 - 60).

Crankshaft ~~box~~ box lubricating oil: During the summer, number T14 machine oil (SYB 1152 - 60) and for the winter Number T8 machine oil (SYB 1152 - 60).

Transmission system lubricating oil: For the summer use ~~g~~ car gear oil (SYB 1103 - 602), and for the winter car gear oil (SYB 1103 - 602).

Yellow oil nozzle lubricating oil: Coal soap base grease (SYB 1401 - 59).

### The Many Uses of Kung-nung Model 7 Tractors

1. Cultivation purposes. Can plough to a depth of 12-16 cm generally (about 14 cm in the case of wetfields and dry fields and about 16 cm in the case of vegetable dry fields) when provided with rotating cultivation blades. If the soil is clayey and the water content low (7-8 %) or high (20 % or more), the depth is about 12 cm. The undulating rate of the cultivation depth usually comes to about 5-7 percent and depends mainly on the degree of ruggedness of the land surface, on the forward going speed of the tractor and on the rotating speed of the cultivation blades.

The tractor's soil-breaking capacity is usually high, the soil-breaking coefficient usually ~~reaching~~ reaching about 70 percent, obtaining ~~an~~ even more than 90 percent in case the water content of the sandy soil is right, i.e. 15 percent. Since the soil gets fine broken up when cultivated with rotary ploughs, the soil gets puffed up to a level of 20-40 percent, ~~xx~~ which is ~~xx~~ very good for retaining water. The land surface and bottom are flat (the degree of ruggedness of the land surface of wetfields is about 10 percent, that of dry fields about 5 percent, that of vegetable fields about 3 percent and the submersion rate about 80 percent).

The proportion of land that does not get ploughed is extremely small: for a standard surface of 50 x 50 m<sup>2</sup> the proportion is 0.85 percent in the case of a wetfield dry cultivation (rubber tires used). ~~For the wetfield, the tractor should be used on 30 percent of the land, and the buffalo on 70 percent.~~ Generally, should one attach across to 30 percent of the four-wheel tractors complementary ploughs, the rate of left uncultivated is 0.08 percent, or ~~1/125th of the land~~ eight times 1/1-150th of the land left unploughed should one use water buffaloes.

For one hour, one usually ~~usually~~ completes 1-1.5 mu, corresponding ~~to the work of 3 draught animals or 25-30 man-days of work, and consuming 0.5 to 0.9 kg of fuel per mu.~~

2. Ploughing operations (when equipped with one L-1-20 model ~~at~~ share, twin-direction plough). Cultivation depth of wetfields come to about 18 cm. Undulation rate about 5-10 percent, reversing at the beginning, good planting submersion (submersion rate about 70 percent), fine soil clods, the soil after ~~first~~ initial cultivation grows puffed by about 30-40 percent, the degree of unevenness is about 10 percent, and the productivity about 0.8 mu per hour corresponding to the work of 1-2 ~~heads~~ head of draught animals, with one mu taking up 1.2-1.5 kg of fuel.

At the time ~~submersion~~ of dry cultivation of the wet fields, since the soil water content is high (above 30 percent), the length of the soil clods reaches 50-60 cm, with the degree of ~~unevenness~~ unevenness of the land surface ~~reaching~~ as high as 40 percent. Otherwise, it is the same as wet cultivation.

For initial cultivation on dry fields, the tractor also gives fine earth clods (40-60 percent), ~~the tractor~~ a rate of plant submersion above 80 percent, a cultivation productivity of 0.7-1 mu/h, one mu requiring 0.9 to 1.3 kg of fuel.

3. Raking operations. There are complex and single operations to be done at the same time as the cultivation. ~~When~~ when there is need for intensive cultivation, these operations are performed at the time of the second cultivation, which the tractor can do to the same level as that done ~~by~~ with water buffaloes. When it is a single operation, the degree of resistance is small and one can use a high speed. At speed V, the productivity is good while requiring but little fuel, yet the quality of the operation is fine: this, however, requires a high level of operating technique ~~as~~ since a great power of concentration is demanded. Generally, it is proper to go at speed III for complex operations and speed IV for single operations. The productivity is 5-8 mu per hour, each mu requiring ~~0.15-0.2 kg of fuel.~~

4. Down pressing (With installation of 3YV-1 Model pressing machine). In treading wheat plants during the spring in the North China dry fields, pressing down after sowing is enough to ~~fulfill~~ fulfill the requirement of agricultural techniques.

Should one use transport rear wheels, one can reduce the labor intensity while raising the speed of the operation. Productivity is 3-7 mu per hour, each mu requiring ~~0.2~~ about 0.2 kg of fuel.

5. Ditch-digging (With installation of earth pounder and of dragging board type or adjustable type excavator). Works best with an adjustable type excavator, giving fine ditches and trapezoid mounds, giving sharp ditch walls with little crumbled earth, and by adjusting the machine one can dig ditches of about 19-25 cm in depth, 50-65 cm in breadth and 10-20 cm in bottom width. Productivity is 800-1000 meters per hour, each hour ~~requiring~~ requiring 0.7-1.2 kg of fuel.

6. Water-pumping. By changing the V-pulley of the motor crankshaft into a plain pulley and by connecting to it a four-inch or six-inch pump, one can pump 50-90 tons of water per hour to irrigate 1-2 mu of land, each hour requiring 0.6-1.2 kg of fuel.

7. Midseason cultivation (With installation of mid-season cultivation machines). Works fine for early mid-season and single mid-season cultivation of ~~most~~ sugar beets, Indian corn and kaoliang, is appropriate for various sowing operations while the rate of young plants that get hurt is low. 50-70 cm spacing out, depth of mid-season cultivation 4-6 cm, weeding rate 90 percent, and young plant hurting rate less than ~~0.1~~ 0.1 percent. Productivity is 4-5 mu per hectare, one mu requiring 0.15 to 0.2 kg of fuel. For pounding, the rate of fuel consumption is somewhat higher, from 0.2 to 0.25 kg per hour.

8. Yam digging (With the use of stockade-type plough). By going at speed V, you dig one row each at each time, exposing from 25-80 percent of the yam with a loss rate relatively high at about 20 percent, productivity 2.5 to 3 mu per ~~hour~~ hour, each mu requiring 0.3-0.5 kg of fuel.

9. Threshing ~~and~~ and other processing of agricultural by-products. Should one connect to the tractor a TY-3 corn husk remover and assign 25 laborers to it, one can reach a productivity of 4000-5000 kg per hour, one hour requiring 1.2-1.4 kg of fuel, grain removing rate of 98 percent and broken grain rate ~~5~~ 5 percent. Besides, one can connect various other machines such as paddy and wheat threshers, cotton gins, rice polishers, and flour grinders, etc.

10. Transportation (Towing a 750 kg-capacity trailer). By changing the motor ~~with~~ to a fast speed pulley, one can get around 12 km per hour at speed V or IV. 7-10 t/km/h, fuel consumption 0.13-0.18 kg/t/km.

#### Operation Costs of a Kung-nung 7 Tractor

Agricultural operations differ from locality to locality and since the economic conditions are not the same everywhere either, as a whole

one cannot compare the costs of operations when done by men and animals on the one hand and by tractors on the other. For instance, should one list out the cultivation operations, the ~~specifying cost~~ operation cost of a hand tractor for every mu in the region of Peking is 1.2-1.35 yuan while that done by animals comes to 1.4 yuan, for Honan we have 1.55 yuan and 1.2-1.3 yuan respectively, and for the region of Shanghai 1.5 yuan and 3.22 yuan respectively. However, the efficiency of a hand tractor is higher than that of domestic animals and its great functions can be promoted during the busy season. According to the accounted costs of two production ~~brigades~~ brigades in the province of Szechuan, using the hand tractor, one can complete the transplanting from six to ten days earlier than if that was done by men and animals, thus representing an increase of 24-33 percent. ~~Also~~ Also, a production brigade in the region of Shanghai has been able to save about 3000 ~~man-days~~ man-days of work during the summer and autumn crops thanks to the use of the tractor. A production brigade in the region of Peking has used one hand tractor to do ~~the~~ the work of two draught animals, then used the two animals to carry fertilizers and others, thus being able to deduct more than ten yuan from the costs.

#### Easy Manipulation and Maintenance

Because the Kung-nung 7 hand tractor is simple in mechanism and therefore convenient for operation, the more knowledgeable youths at the countryside can learn to use it independently ~~and be able to~~ after about one month of training, then after manipulating it for about one or two operation seasons, they can do simple maintenance work and repair minor ~~and~~ ~~breakdowns~~ breakdowns. The motor is started manually and should the technical conditions be right, and the temperature below 5-10°C, it should start after two or three seconds. If the temperature drops below ~~10~~ 0°C, one should pour hot water on the machine and it should start after about 5 to 7 minutes. The operating force needed for various control ~~sticks~~ sticks is below 10 kg.

Maintenance is relatively easy, with one man spending about 30 minutes each time it should be enough. As for tools, there are eight kinds and 11 points to remember. Number 1 maintenance requires one man spending 1 hour and a half using 10 kinds of tools and checking 16 points, number 2 maintenance requires one man spending half a day using 20 tools and checking 28 points, and number 3 maintenance requires two men spending two days using 26 tools and checking 37 points. By testing from 1500 to 2000 hours, the ~~coefficient of maintenance~~ maintenance coefficient is found to be about 10 percent.

Repair work is convenient, needing no jacking equipment and with the exception of crankshaft friction and inside boring of cylinders all the repair work can be done on a self-help basis, even the overhaul work can be done at some people's communes that have the conditions, thus saving time and money.

According to an assessment of the tests carried out in the last two years at various localities, the degree of reliability of the machines is about 90 percent. After 1000 hours of use, the motor still retains its stipulated generating power while fuel consumption rises to about 200 grams per hour per ~~xxx~~ horse-power. After 2000 hours of use, the stipulated generating power drops by about 0.5 ~~xxx~~ horsepower while fuel consumption rises to 250 grams per horsepower per hour. Now, ~~xxxxxxx~~ the efficiency and anti-friction capacity of part of the parts have become good ~~xxxxxxx~~ with another part getting better and better.

#### Several Remaining Problems

As far as the deficiencies of the Kung-nung 7 hand tractor are concerned, the cultivation depth ~~ix~~ still ~~xxxx~~ does not go ~~xxx~~ far enough, ~~xxx~~ while the ~~ix~~ machine still does not break the earth fine enough, it is still hard to turn about. For this reason, they cannot be used for intensive cultivation, autumn cultivation and turning about during winter cultivation. As the machine is long, it is hard to change direction, dust and mud stick to it, and at dry cultivation of the paddy fields should the water content be high and the earth stick too much to the machine, various problems arise. ~~ix~~

As for what should be improved upon in the future, it should have more accessory implements so that it can be used for all kind of agricultural operations. Besides, there is also the problems of the plough structure, of its hardness, of its strength, and of its manufacturing quality. The ~~xxxx~~ depth and width of the ploughing operations also are still ~~xxxx~~ unstable. The redemption and maintenance costs of the agricultural implements ~~xxxx~~ as well as of the tractor are said to come to 60 percent of the total operations costs, thus ~~raising the cost of production~~ ~~xxxxxxx~~ it is necessary to lower the cost of production of same, to raise their ~~xxx~~ quality and to better the longevity of the parts. Thus ~~xxxx~~ it is necessary to stabilize and better the quality of the parts one step further, to improve upon their construction. For instance, there is still room for improvement in regard to the three ~~ix~~ valves of the motor (intake valve, exhaust valve, and loading valve of the fuel pump), the three filters (air filter, fuel filter, lubricating oil filter), the wheels for use in paddy fields, the cultivation rear wheels, and the gear clutch, etc. It is also necessary to better the protection against water in case of operations in paddy fields. The running wheels of the tractor do not cling fast, the draught efficiency is still low while the ~~xxxx~~ hauling power is weak: thus it is necessary to improve the whole running system, to rearrange it, to make it stay fast, to improve upon the use efficiency for weights as well as upon the hauling power.

At present, the new tractor is being manufactured everywhere according to the standard design charts, in Shanghai, Ch'angchou, Wuhan, Fukiens, and Shenyang. In Shanghai and Ch'ang-chou, the combustion room

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has been improved upon, the machine ~~has~~ powered up, various parts such as the fuel nozzle, the piston, the cylinder ~~cover~~ cover, etc. bettered or ~~is~~ in the process of being experimented with. Also, in Shenyang the tractor has had its capacity stabilized for use on ridge-separated lands, and in order to make use of the connection of various agricultural implements, the structures of the chassis and of the connections have been improved upon. Thus, when the Kung-nung 7 hand tractor has ~~is~~ been improved upon and then mass produced, there is no doubt that because of ~~its extraordinary appropriateness~~ its extraordinary appropriateness to the intensive cultivation and local industries of China, it will be widely propagated to the people's communes everywhere.

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